

REMARKS

Applicant has amended claim 1 to recite, *inter alia*, “the material of seed layer comprising tungsten.” Claim 1 includes additional amendments to improve the form of the claim. Additionally, Applicant has added new claims 65 and 66. Support for the amendments and new claims 65 and 66 may be found in the as-filed specification at at least paragraphs [0022] and [0025] and in the claims as originally filed. Accordingly, no new matter has been added.

The Office Action mailed October 18, 2007, has been received and reviewed. Claims 1 through 6, 9 through 15 and 64 are currently pending in the application. Claims 1 through 6, 9 through 15 and 64 stand rejected. Applicant has amended claim 1 and added claims 65 and 66, and respectfully requests reconsideration of the application as amended herein.

35 U.S.C. § 112 Claim Rejections

Claim 1 stands rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement for containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. Applicant respectfully traverses this rejection, as hereinafter set forth.

It was stated that the specification lacks support for a conductive layer substantially within the recess, as recited in claim 1. Applicant respectfully disagrees, as FIG. 2 of the as-filed specification clearly shows conductor layer 28 on the seed layer 26 and substantially within the recess 20. See also, as-filed specification, page 12, lines 7-14 and page 10, lines 18-25. Accordingly, reconsideration and withdrawal of the rejection is requested.

Additionally, Applicant notes that an identical rejection was made and withdrawn in the previous two Office Actions, specifically the rejection being set forth in the Office Action mailed February 9, 2007, and withdrawn in the Office Action mailed July 26, 2007.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,926,736 to DeSilva in view of U.S. Patent No. 5,420,072 to Fiordalice et al.

Claims 1 through 6, 9 through 14 and 64 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over DeSilva (U.S. Patent No. 5,926,736) in view of Fiordalice et al. (U.S. Patent No. 5,420,072). Applicant respectfully responds to this rejection, as hereinafter set forth.

To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Royka*, 490 F.2d 981, 985 (CCPA 1974); *see also* MPEP § 2143.03. Additionally, the Examiner must determine whether there is “an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-1741, 167 L.Ed.2d 705, 75 USLW 4289, 82 U.S.P.Q.2d 1385 (2007). Further, rejections on obviousness grounds “cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *Id* at 1741, quoting *In re Kahn*, 441, F.3d 977, 988 (Fed. Cir. 2006). Finally, to establish a *prima facie* case of obviousness, there must be a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Furthermore, the reason that would have prompted the combination and the reasonable expectation of success must be found in the prior art, common knowledge, or the nature of the problem itself, and not based on the Applicant’s disclosure. *DyStar Textilfarben GmbH & Co. Deutschland KG v. C. H. Patrick Co.*, 464 F.3d 1356, 1367 (Fed. Cir. 2006); MPEP § 2144. Underlying the obvious determination is the fact that statutorily prohibited hindsight cannot be used. *KSR*, 127 S.Ct. at 1742; *DyStar*, 464 F.3d at 1367.

DeSilva teaches forming an interconnect structure by forming one or more holes within a insulating layer on a substrate, forming a barrier layer over the holes, placing the structure in a vacuum chamber, and depositing and forming an aluminum layer over the barrier layer. DeSilva at Figures 1 through 5 and column 2, line 30 through column 3, line 67. An antireflective coating is formed on the aluminum layer. *Id*. The structure is subsequently heated to melt the aluminum layer, allowing aluminum to fill in the holes within the insulating layer. *Id*.

Fiordalice teaches forming an interconnect structure by forming an opening within a

dielectric material, depositing a first layer of titanium nitride over the dielectric material, depositing a second layer of titanium nitride over the first layer, and forming a conductive layer overlying the second layer. Fiordalice at FIGs. 1-6, column 2, line 48 through column 4, line 50. Alternatively, after depositing the second layer of titanium nitride, a conductive plug of tungsten material is deposited or layered such that the opening is substantially filled. *Id.* at FIGs. 7-8 and column 4, lines 50-62. Portions of the tungsten material are removed to expose portions of the second layer of titanium nitride. *Id.* at column 4, lines 62-65.

Applicant submits that the claims, as currently amended, are not obvious under 35 U.S.C. § 103 as none of the applied references teaches or suggests all of the claim limitations. Specifically, claim 1 has been amended to recite, *inter alia*, “forming a seed layer on the diffusion barrier layer over the top surface of the dielectric material and within the recess, . . . wherein the material of the seed layer comprises tungsten.”

In contrast to claim 1, DeSilva or Fiordalice, alone or in combination, do not teach or suggest forming a seed layer that comprises tungsten. While Fiordalice teaches forming a seed layer (first titanium nitride layer 22, Fiordalice at column 3, lines 40-64), Fiordalice teaches that the seed layer is formed from titanium nitride.

Additionally, no articulated reasoning with rational underpinning has been provided by the Examiner to support the legal conclusion of obviousness because the applied references do not provide a reason that would have prompted the combination. Specifically, nowhere in Fiordalice or DeSilva is there any articulated reasoning that would have prompted one of ordinary skill in the art to modify the structure of DeSilva by adding a seed layer. Furthermore, neither DeSilva nor Fiordalice provides any articulated reasoning to change the first titanium nitride layer 22 of Fiordalice to be a different material, such as tungsten. In addition, the common knowledge or the nature of the problem does not provide a reason that would have prompted the combination.

While Fiordalice teaches that a tungsten material is used in its interconnect structure, the tungsten material forms the conductive layer that is deposited over the second layer of titanium nitride 24, filling the recess, and ultimately becoming the conductive plug 30. Fiordalice at column 4, lines 51-68. Applicant respectfully submits that it would not have been obvious for

one of ordinary skill in the art to form a seed layer of tungsten based on the use of tungsten as a conductive layer in Fiordalice. Specifically, the purpose and function of the tungsten in Fiordalice are different to that of the seed layer recited in claim 1. In contrast to the teachings of Fiordalice, forming the seed layer from tungsten, as recited in claim 1, promotes the deposition and growth of the electrically conductive layer and prevents contaminants from entering and inhibiting surface diffusion.

In light of the above, Applicant submits that independent claim 1 is allowable and, accordingly, requests withdrawal of the 35 U.S.C. 103(a) obviousness rejection.

The nonobviousness of independent claim 1 precludes a rejection of claims 2-6, 9-14, and 64 which depend therefrom, because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03.

Therefore, Applicant respectfully requests that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection of independent claim 1 and claims 2-6, 9-14, and 64, which depend therefrom.

Obviousness Rejection Based on U.S. Patent No. 5,926,736 to DeSilva in view of U.S. Patent No. 5,420,072 to Fiordalice et al. and further in view of U.S. Patent No. 5,869,395 to Yim

Dependent claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over DeSilva (U.S. Patent No. 5,926,736) in view of Fiordalice et al. (U.S. Patent No. 5,420,072) as applied to claims 1 through 6, 9 through 14 and 64, and further in view of Yim (U.S. Patent No. 5,869,395). Applicant respectfully traverses this rejection, as hereinafter set forth.

Claim 15 is allowable because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03.

New Claims 65 and 66

Applicant has added new claims 65 and 66, which recite, *inter alia*, forming a barrier layer and forming a seed layer on top of the barrier layer, wherein the barrier layer is of a

different material than the seed layer (claim 65) or wherein the barrier layer has a greater melting point than the material of the seed layer (claim 66).

Claims 65 and 66 are allowable as none of the applied references disclose, teach or suggest using different materials in the barrier layer and the seed layer.

ENTRY OF AMENDMENTS

The amendments to claim 1 and new claims 65 and 66 should be entered by the Examiner because the amendments and new claims are supported by the as-filed specification and drawings and do not add new matter to the application.

CONCLUSION

Claims 1-6, 9-15, and 64-66 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicant's undersigned attorney.

Respectfully submitted,



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